

Claims

1 1. A route search method for a navigation device,
2 wherein

3 the navigation device includes a storage device which
4 stores map data including link data of respective links
5 constituting roads on a map, and statistical data including
6 travel time or moving speeds of the respective links
7 determined by statistical values of traffic information
8 collected in the past, said statistical data being classified
9 every condition of collection of the traffic information,
10 and

11 the route search method comprises:

12 setting step which sets a departure position, a
13 destination, and conditions of collection; and

14 recommended route searching step which searches a
15 recommended route from the departure position to the
16 destination, by using the map data stored in the storage
17 device and statistical data corresponding to the conditions
18 of collection set in the setting step out of the statistical
19 data stored in the storage device.

1 2. The route search method according to claim 1,
2 wherein

3 the statistical data includes travel time or moving
4 speeds of the respective links every time zone, and

5 the recommended route searching step searches the

6 recommended route by using, as travel time of respective
7 first candidate links constituting the recommended route,
8 travel time corresponding to a time zone including a departure
9 point of time at the departure position included or travel
10 time obtained from moving speeds corresponding to the time
11 zone concerning and, as travel time of respective (n)th ($n \geq 2$)
12 candidate links constituting the recommended route, travel
13 time corresponding to a time zone including an expected
14 arrival point of time at the termination node of a (n-1)th
15 candidate link contiguous to the (n)th candidate link or
16 travel time obtained from moving speeds corresponding to
17 the time zone concerned.

1 3. The route search method according to claim 1,
2 further comprising:

3 travel time calculating step which calculates travel
4 time or an expected arrival point of time for the recommended
5 route by using travel time of respective links constituting
6 the recommended route used in searching the recommended route
7 in the recommended route searching step, and

8 travel time displaying step which displays travel time
9 or an expected arrival point of time for the recommended
10 route which is calculated in the travel time calculating
11 step.

1 4. The route search method according to claim 3,

2 wherein

3 the statistical data includes a degree of dispersion
4 in traffic information being a source of travel time or moving
5 speeds of the respective links,

6 the travel time calculating step calculates an error
7 in travel time for the recommended route by using degree
8 of dispersion in traffic information being a source of travel
9 time or moving speeds of respective links constituting the
10 recommended route, said travel time or moving speeds being
11 used in searching the recommended route in the recommended
12 route searching step, and

13 the travel time displaying step displays travel time
14 or an expected arrival point of time for the recommended
15 route which is calculated in the travel time calculating
16 step, and an error thereof.

1 5. The route search method according to claim 3,
2 wherein

3 the statistical data includes a degree of jam every
4 time zone of the respective links,

5 the travel time calculating step determines a degree
6 of jam in respective sections which are obtained by dividing
7 the recommended route into a plurality of the sections, by
8 using a degree of jam in a time zone corresponding to travel
9 time or moving speeds of respective links constituting the
10 recommended route, said travel time or moving speeds being

11 used in searching the recommended route in the recommended
12 route searching step, and

13 the travel time displaying step displays travel time
14 for the recommended route which is calculated in the travel
15 time calculating step, and a degree of jam in the respective
16 sections of the recommended route.

1 6. The route search method according to claim 2,
2 wherein

3 the navigation device has a current position
4 calculating function, and further comprising:

5 route guidance step which performs route guidance to
6 the destination by using the recommended route searched in
7 the recommended route searching step and the current position
8 calculated by the current position calculating function,
9 and

10 expected arrival point of time correcting step which
11 corrects an expected arrival point of time at the destination
12 by calculating travel time for a section between the
13 destination and the current position which disposed on the
14 recommended route and is calculated by the current position
15 calculating function, wherein

16 the expected arrival point of time correcting step
17 calculates travel time for the section, by using, as travel
18 time for a first link constituting the section, travel time
19 corresponding to a time zone including current time, or travel

20 time obtained from moving speeds corresponding to the time
21 zone concerned, and as travel time for respective (m)th ($m \geq 2$)
22 links constituting the section, travel time corresponding
23 to a time zone including a point of time obtained by adding
24 to current time total travel time between the first link
25 and a (m-1)th link, or travel time obtained from moving speeds
26 corresponding to the time zone concerned, and adds to current
27 time the travel time for the section to obtain an expected
28 arrival point of time at the destination.

1 7. The route search method according to claim 2,
2 wherein

3 the navigation device has a current position
4 calculating function, and further comprising:

5 route guidance step which performs route guidance to
6 a destination by using a recommended route searched in the
7 recommended route searching step and a current position
8 calculated by the current position calculating function,
9 and

10 re-search judgment step which compares actual travel
11 time for a section on the recommended route from the departure
12 position to the current position, with travel time for the
13 section concerned on the recommended route which is obtained
14 from travel time for respective links constituting the
15 recommended route and used in searching the recommended route
16 in the recommended route searching step, and judges the

17 necessity of searching a recommended route again according
18 to the result of the comparison, and wherein
19 the route searching step searches a recommended route
20 to the destination set in the setting step again with the
21 current position calculated by the current position
22 calculating function as a departure position and current
23 time as a departure point of time in the case where it is
24 judged in the re-search judgment step that it is necessary
25 to search a recommended route again.

1 8. A route search method for a navigation device which
2 has a current position detecting function, wherein
3 the navigation device includes a storage device which
4 stores map data including link data of respective links,
5 and statistical data including travel time or moving speeds
6 of the respective links constituting roads on the map, said
7 travel time or moving speeds being determined by traffic
8 information statistical values collected in the past, and
9 the route search method comprising:

10 setting step which sets a departure position,
11 present status data obtaining step which obtains
12 present status data including travel time or moving speeds
13 determined by present traffic information of respective
14 links located in a peripheral region of the current position
15 detected by the current position detecting function, from
16 outside, and

17 route searching step which searches a recommended route
18 from the current position to the destination by using the
19 map data and the statistical data stored in the storage device
20 and the present status data obtained in the present status
21 data obtaining step.

1 9. The route search method according to claim 8,
2 further comprising

3 general present status data obtaining step which
4 obtains general present status data including a degree of
5 jam in respective links located in the peripheral region
6 of the current position, from outside, and wherein

7 the statistical data includes a degree of jam in travel
8 every link, and

9 in the case where a degree of jam in respective links
10 located in the peripheral region of the current position,
11 which is indicated by the general present status data, and
12 a degree of jam in respective links located in the peripheral
13 region of the current position, which is included in the
14 statistical data, are different from each other, the present
15 status data obtaining step obtains present status data of
16 respective links located in the peripheral region of the
17 current position, from outside,.

1 10. The route search method according to claim 8,
2 further comprising

3 general present status data obtaining step which
4 obtains general present status data including a degree of
5 jam in respective links located in the peripheral region
6 of the current position, from outside, and wherein

7 the present status data includes a degree of jam in
8 travel every link, and

9 in the case where the general present status data of
10 respective links located in the peripheral region of the
11 current position has been obtained, and a degree of jam in
12 respective links located in the peripheral region of the
13 current position, which is indicated by the general present
14 status data concerned, and a degree of jam in respective
15 links located in the peripheral region of the current position,
16 which is indicated by the already obtained general present
17 status data, are different from each other,

18 the present status data obtaining step obtains again,
19 from outside, present status data of respective links located
20 in the peripheral region of the current position.

1 11. The route search method according to claim 8,
2 wherein

3 the present status data obtaining step does not newly
4 obtains present status data of respective links located in
5 the current position, from outside, until a predetermined
6 period of time has elapsed since the present status data
7 is obtained.

1 12. The route search method according to claim 8,
2 wherein

3 the present status data obtaining step newly obtains
4 present status data of respective links located in the
5 peripheral region of the current position, from outside,
6 in the case where a predetermined period of time has elapsed
7 since the present status data is obtained.

1 13. The route search method according to claim 8,
2 further comprising

3 traffic restriction information obtaining step which
4 obtains traffic restriction information for roads from
5 outside, and wherein

6 the present status data obtaining step obtains present
7 status data of respective links located in the peripheral
8 region of the current position, from outside, in the case
9 where traffic restriction information for the peripheral
10 region of the current position is obtained.

1 14. The route search method according to claim 8,
2 wherein

3 the route searching step searches the recommended route
4 by using, as travel time for respective first candidate links
5 constituting the recommended route, travel time in the
6 present status data or travel time obtained from moving speeds
7 in the present status data, and as travel time for respective

8 (n)th ($n \geq 2$) candidate links constituting the recommended
9 route, travel time in the present status data or travel time
10 obtained from moving speeds in the present status data, which
11 is provided in the case that a time difference between an
12 expected arrival point of time at the termination node of
13 a (n-1)th link contiguous to the (n)th link and a departure
14 point of time at the departure position is below a
15 predetermined value, and travel time in the statistical data
16 or travel time obtained from moving speeds in the statistical
17 data, which is provided in the case that the time difference
18 is not less than the predetermined value.

1 15. The route search method according to claim 8,
2 wherein

3 the route searching step searches the recommended route
4 by using, as travel time for candidate links of respective
5 links constituting the recommended route, travel time in
6 the present status data or travel time obtained from moving
7 speeds in the present status data for candidate links located
8 in the peripheral region of the current position, and travel
9 time in the statistical data or travel time obtained from
10 moving speeds for candidate links located outside the
11 peripheral region of the current position.

1 16. The route search method according to claim 8,
2 further comprising:

3 travel time calculating step which calculates travel
4 time for the recommended route or an expected arrival point
5 of time by using travel time of respective links constituting
6 the recommended route used in searching the recommended route
7 in the route searching step, and

8 travel time displaying step which displays travel time
9 for the recommended route or an expected arrival point of
10 time calculated in the travel time calculating step, and
11 wherein

12 the statistical data and the present status data include
13 a degree of jam in every link,

14 the travel time calculating step determines a degree
15 of jam in respective sections which are obtained by dividing
16 the recommended route into a plurality of the sections, by
17 using a degree of jam in the present status data for the
18 link for which the present status data are used in the route
19 searching step, and a degree of jam in the present status
20 data for the link for which the statistical data are used
21 in the route searching step, among links constituting the
22 recommended route, and

23 the travel time displaying step displays travel time
24 for the recommended route calculated in the travel time
25 calculating step, and a degree of jam in respective sections
26 of the recommended route.

1 17. The route search method according to claim 8,

2 further comprising:

3 travel time calculating step which calculates travel
4 time or an expected arrival point of time for the recommended
5 route searched in the route searching step by using the
6 statistical data stored in the storage device and the present
7 status data obtained in the present status data obtaining
8 step, and

9 travel time displaying step which displays travel time
10 for the recommended route or an expected arrival point of
11 time calculated in the travel time calculating step.

1 18. The route search method according to claim 8,
2 further comprising:

3 route guidance step which performs route guidance to
4 the destination by using the recommended route searched in
5 the recommended route searching step and the current position
6 calculated by the current position calculating function,
7 and

8 expected arrival point of time correcting step which
9 corrects an expected arrival point of time at the destination
10 by calculating travel time for a section between the
11 destination and the current position which is disposed on
12 the recommended route, and wherein

13 the expected arrival point of time correcting step
14 calculates travel time for the section, by using, as travel
15 time for a first link constituting the section, travel time

16 for the link determined from the present status data or travel
17 time obtained from moving speeds for the link determined
18 from the present status data, and as travel time for
19 respective (m)th ($m \geq 2$) links constituting the section,
20 travel time for the links determined from the present status
21 data or travel time obtained from moving speeds for the links
22 determined from the present status data , which is provided
23 in the case that total travel time from the first link to
24 a (m-1)th link is below a predetermined value, and travel
25 time for the link in the statistical data or travel time
26 obtained from moving speeds for the link in the statistical
27 data, which is provided in the case that the total travel
28 time is not less than the predetermined value, and adds travel
29 time for the section to current time to obtain an expected
30 arrival point of time at the destination.

1 19. The route search method according to claim 8,
2 further comprising:

3 route guidance step which performs route guidance to
4 the destination by using the recommended route searched in
5 the recommended route searching step and the current position,
6 and

7 expected arrival point of time correcting step which
8 corrects an expected arrival point of time at the destination
9 by calculating travel time for a section between the
10 destination and the current position disposed on the

11 recommended route, and wherein
12 the expected arrival point of time correcting step
13 calculates travel time for the section, by using, as travel
14 time for respective links constituting the section, travel
15 time for links located in the peripheral region of the current
16 position in the present status data or travel time obtained
17 from moving speeds for the links concerned in the present
18 status data, and travel time for links located outside the
19 peripheral region of the current position in the statistical
20 data or travel time obtained from moving speeds for the links
21 concerned in the statistical data, and adds to current time
22 the travel time for the section to obtain an expected arrival
23 point of time at the destination.

1 20. A traffic information display method for a
2 navigation device, wherein
3 the navigation device includes a storage device which
4 stores map data including link data of respective links
5 constituting roads on a map, and statistical data
6 representative of that degree of jam every time zone in the
7 respective links which is determined from statistical values
8 of traffic information collected in the past, said
9 statistical data being classified every condition of
10 collection of the traffic information,
11 the traffic information display method comprises:
12 setting step which sets conditions of collection,

13 reading out step which reads out from the storage device
14 statistical data corresponding to the conditions of
15 collection, out of the statistical data of the respective
16 links included in the map data displayed on a display device,
17 and

18 degree of jam displaying step which displays a degree
19 of jam every time zone of the respective links specified
20 by the read statistical data overlappingly on the map
21 displayed on the display device.